

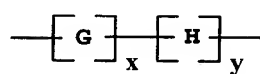
WHAT IS CLAIMED IS:

1. A polymer particles comprising a polymer bead stabilized by vinylsulfonyl-functionalized polymers grafted to the surface of said bead.
2. The polymer particle of claim 1 wherein said polymer bead comprises a water insoluble synthetic polymer.
3. The polymer particle of claim 1 wherein said polymer bead comprises at least one polymer selected from the group consisting of polystyrene, polyacrylate esters, or polymethacrylate esters.
4. The polymer particle of claim 1 wherein said polymer bead comprises a polymer made from at least one monomer containing α,β -ethylenic unsaturation.
5. The polymer particle of claim 4 wherein said monomer comprises a monomer having limited solubility in water.
6. The polymer particle of claim 5 wherein said polymer bead further comprises less than 10% of the total weight of the polymerizable solids, of one or more water-soluble ethylenically unsaturated monomers
7. The polymer particle of claim 4 wherein said monomer comprises at least one member selected from the group consisting of styrenics, acrylic esters, methacrylic esters, acrylamides, methacrylamides, or vinyl esters.
8. The polymer particle of claim 1 wherein said vinylsulfonyl-functionalized polymer comprises vinylsulfonyl or vinylsulfonyl precursor moieties grafted to the surface of said polymer bead.

9. The polymer particle of claim 8 wherein said vinylsulfonyl-functionalized polymer comprises acrylamide or methacrylamide monomers.

10. The polymer particle of claim 8 wherein said vinylsulfonyl-functionalized polymer comprises latent vinylsulfonyl-functionalized polymers.

11. The polymer particle of Claim 8 wherein said vinylsulfonyl-functionalized polymers are represented by Formula I:



Formula I

wherein

“G” represents a polymerized α,β -ethylenically unsaturated addition polymerizeable monomer;

“H” represents a vinylsulfone or vinylsulfone precursor unit monomer; and

x and y both represent molar percentages ranging from 10 to 90 and 90 to 10.

12. The polymer particle of Claim 11 wherein x and y range from 25 to 75 and 75 to 25 respectively.

13. The polymer particle of Claim 11 wherein G represents nonionic or ionic monomers.

14. The polymer particle of Claim 13 wherein said ionic monomers comprise at least one member selected from the group consisting of 2-phosphatoethyl acrylate potassium salt, 3-phosphatopropyl methacrylate ammonium salt, acrylamide, methacrylamides, maleic acid and salts thereof, sulfopropyl acrylate and methacrylate, acrylic and methacrylic acids and salts

thereof, N-vinylpyrrolidone, acrylic and methacrylic esters of alkylphosphonates, styrenics, acrylic and methacrylic monomers containing amine ammonium functionalities, styrenesulfonic acid and salts thereof, acrylic and methacrylic esters of alkylsulfonates, vinylsulfonic acid and salts thereof.

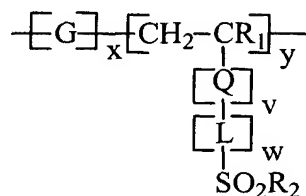
15. The polymer particle of Claim 13 wherein said nonionic monomers comprise at least one member selected from the group consisting of poly(ethylene oxide) segments, carbohydrates, amines, amides, alcohols, polyols, nitrogen-containing heterocycles, and oligopeptides.

16. The polymer particle of Claim 13 wherein said nonionic monomers comprise at least one member selected from the group consisting of poly(ethylene oxide) acrylate and methacrylate esters, vinylpyridines, hydroxyethyl acrylate, glycerol acrylate and methacrylate esters, (meth)acrylamide, and N-vinylpyrrolidone.

17. The polymer particle of Claim 11 wherein G represents the polymerized form of acrylamide, sodium 2-acrylamido-2-methanepropionate, sulfopropyl acrylate and methacrylate salts, or sodium styrenesulfonate.

18. The polymer particle of Claim 11 wherein H represents the polymerized form of a vinylsulfone or vinylsulfone precursor unit.

19. The polymer particle of Claim 11 wherein said "H" represents groups represented by Formula II:



Formula II

wherein:

R_1 is a hydrogen atom or a C_1 - C_6 alkyl group;

Q is $-CO_2-$, or $CONR_1$;

v is 1 or 0;

w is 1-3;

L is a divalent linking group containing at least one linkage selected from the group consisting of $-CO_2-$ and $-CONR_1$, and containing 3-15 carbon atoms, or a divalent atom containing at least one linkage selected from the group consisting of $-O-$, $-N(R_1)-$, $-CO-$, $-SO-$, $-SO_2-$, $-SO_3-$, $-SO_2N(R_1)-$, $-N(R_1)CON(R_1)-$ and $-N(R_1)CO_2-$, and containing 1-12 carbon atoms in which R_1 has the same meaning as defined above; and

R_2 is $-CH=CH_2$ or $-CH_2-CH_2X_1$ wherein X_1 is a substituent replaceable by a nucleophilic group or releasable in the form of HX_1 by a base.

20. The polymer particle of Claim 19 wherein X_1 represents $-S_2O_3^-$, $-SO_4^-$, $-Cl$, $-Br$, $-I$, quaternary ammonium, pyridinium, and $-CN$, and sulfonate esters.

21. The polymer particle of claim 1 wherein said particle comprises an average diameter from 0.2 to 100 microns.

22. The polymer particle of claim 1 wherein said particle comprises an average diameter from 0.5 to 20 microns.

23. The polymer particle of claim 1 wherein further comprising a bioaffinity tag bound to the surface of said bead.

24. The polymer particle of claim 1 further comprising a bioaffinity tag bound to said bead by attachment to said vinylsulfonyl-functionalized polymer.

25. The polymer particle of claim 23 wherein said bioaffinity tag is covalently bound.

26. The polymer particle of claim 11 wherein said bioaffinity tag comprises at least one member selected from the group consisting of nucleic acids, antibodies, proteins, polysaccharides, oligonucleotides, peptide nucleic acid (PNA), peptides, antibodies, antigens, enzymes, proteins, and synthetic molecules having biological activities

27. The polymer particle of claim 26 wherein said nucleic acid is terminally modified to contain one or more than one chemical functional groups.

28. The polymer particle of claim 27 wherein said one or more than one chemical functional groups comprise amino, thiol, carboxyl, biotin, and digoxigenin.

29. A particle composition comprising monodisperse polymer beads stabilized by vinylsulfonyl-functionalized polymers, wherein said vinylsulfonyl-functionalized polymers are grafted to the external surfaces of said beads.

30. The composition of claim 29 wherein said monodisperse polymer particles comprise a coefficient of variation in the particle diameter of less than 20%.

31. The composition of claim 29 wherein said monodisperse polymer particles comprise a coefficient of variation in the particle diameter of less than 15%.

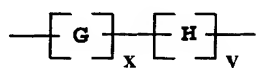
32. The composition of claim 29 wherein said monodisperse polymer particles comprise a coefficient of variation in the particle diameter of less than 10%.

33. The composition of claim 29 wherein said polymer bead comprises a polymer made from at least one monomer containing α,β -ethylenic unsaturation.

34. The composition of claim 29 wherein polymer bead comprises a polymer made from at least one monomer comprising a monomer having limited solubility in water and wherein said polymer bead further comprises less than 10% of the total weight of the polymerizeable solids, of one or more water-soluble ethylenically unsaturated monomers

35. The composition of claim 29 wherein said vinylsulfonyl-functionalized polymer comprises vinylsulfonyl or vinylsulfonyl precursor moieties grafted to the surface of said polymer bead.

36. The composition of Claim 35 wherein said vinylsulfonyl-functionalized polymers are represented by Formula I:



Formula I

wherein

"G" represents a polymerized α,β -ethylenically unsaturated addition polymerizeable monomer;

"H" represents a vinylsulfone or vinylsulfone precursor unit monomer; and

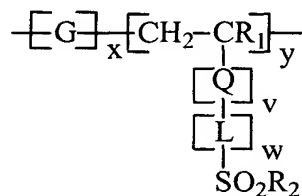
x and y both represent molar percentages ranging from 10 to 90 and 90 to 10.

37. The composition of Claim 36 wherein G represents nonionic or ionic monomers.

38. The composition of Claim 36 wherein G represents the polymerized form of acrylamide, sodium 2-acrylamido-2-methanepropionate, sulfopropyl acrylate and methacrylate salts, or sodium styrenesulfonate.

39. The composition of Claim 36 wherein H represents the polymerized form of a vinylsulfone or vinylsulfone precursor unit.

40. The composition of Claim 36 wherein said "H" represents groups represented by Formula II:



Formula II

wherein:

R₁ is a hydrogen atom or a C₁-C₆ alkyl group;

Q is -CO₂-, or CONR₁;

v is 1 or 0;

w is 1-3;

L is a divalent linking group containing at least one linkage selected from the group consisting of -CO₂- and -CONR₁, and containing 3-15 carbon atoms, or a divalent atom containing at least one linkage selected from the group consisting of -O-, -N(R₁)-, -CO-, -SO-, -SO₂-, -SO₃-, -SO₂N(R₁)-, -N(R₁)CON(R₁)- and -N(R₁)CO₂-, and containing 1-12 carbon atoms in which R₁ has the same meaning as defined above; and

R₂ is -CH=CH₂ or -CH₂-CH₂X₁ wherein X₁ is a substituent replaceable by a nucleophilic group or releasable in the form of HX₁ by a base.

41. The composition of Claim 40 wherein X_1 represents $-S_2O_3^-$, $-SO_4^-$, $-Cl$, $-Br$, $-I$, quaternary ammonium, pyridinium, and $-CN$, and sulfonate esters.

42. The composition of claim 29 wherein further comprising a bioaffinity tag bound to the surface of said bead.

43. The composition of claim 42 wherein said bioaffinity tag comprises at least one member selected from the group consisting of nucleic acids, antibodies, proteins, polysaccharides, oligonucleotides, peptide nucleic acid (PNA), peptides, antibodies, antigens, enzymes, proteins, and synthetic molecules having biological activities

44. A method of preparing monodisperse polymer particles comprising preparing a homogeneous solution of at least one ethylenically unsaturated polymerizable monomer, an initiator, and a polymeric stabilizer, wherein said polymeric stabilizer consists of repetitive units, wherein said repetitive units comprise at least one latent vinylsulfonyl moiety, polymerizing said homogeneous solution, and converting said at least one latent vinylsulfonyl moiety to vinylsulfonyl moieties.

45. The method of claim 44 wherein said initiator is selected from the group consisting of azo compounds, organoperoxides, organohydroperoxides, persulfate salts, and redox initiators.

46. The method of claim 44 wherein said initiating polymerization comprises heating.

47. The method of claim 46 wherein said heating comprises a temperature from 35C to 85C.

48. The method of claim 46 wherein said heating comprises a temperature at which said initiator initiates polymerization.

49. The method of claim 44 wherein said solution of said ethylenically unsaturated polymerizable monomer, said initiator, and said polymeric stabilizer further comprises solvent.

50. The method of claim 49 wherein said solvent comprises water, methanol, ethanol, n-propanol, isopropanol, acetone, or glycol ethers.

51. The method of claim 49 wherein said polymer particle is insoluble in said solvent.

52. The method of claim 44 further comprising purifying said polymer particles.

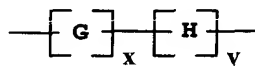
53. The composition of claim 44 wherein said monodisperse polymer particles comprise a coefficient of variation in the particle diameter of less than 20%.

54. The composition of claim 44 wherein said polymer bead comprises a polymer made from at least one monomer containing α,β -ethylenic unsaturation.

55. The composition of claim 44 wherein polymer bead comprises a polymer made from at least one monomer comprising a monomer having limited solubility in water and wherein said polymer bead further comprises less than 10% of the total weight of the polymerizable solids, of one or more water-soluble ethylenically unsaturated monomers

56. The composition of claim 44 wherein said vinylsulfonyl-functionalized polymer comprises vinylsulfonyl or vinylsulfonyl precursor moieties grafted to the surface of said polymer bead.

57. The composition of Claim 56 wherein said vinylsulfonyl-functionalized polymers are represented by Formula I:



Formula I

wherein

“G” represents a polymerized α,β -ethylenically unsaturated addition polymerizeable monomer;

“H” represents a vinylsulfone or vinylsulfone precursor unit monomer; and

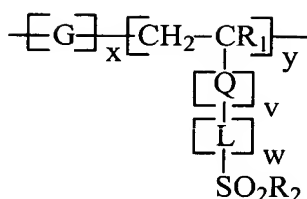
x and y both represent molar percentages ranging from 10 to 90 and 90 to 10.

58. The composition of Claim 57 wherein G represents nonionic or ionic monomers.

59. The composition of Claim 57 wherein G represents the polymerized form of acrylamide, sodium 2-acrylamido-2-methanepropionate, sulfopropyl acrylate and methacrylate salts, or sodium styrenesulfonate.

60. The composition of Claim 57 wherein H represents the polymerized form of a vinylsulfone or vinylsulfone precursor unit.

61. The composition of Claim 57 wherein said “H” represents groups represented by Formula II:



Formula II

wherein:

R₁ is a hydrogen atom or a C₁-C₆ alkyl group;

Q is -CO₂-, or CONR₁;

v is 1 or 0;

w is 1-3;

L is a divalent linking group containing at least one linkage selected from the group consisting of -CO₂- and -CONR₁, and containing 3-15 carbon atoms, or a divalent atom containing at least one linkage selected from the group consisting of -O-, -N(R₁)-, -CO-, -SO-, -SO₂-, -SO₃-, -SO₂N(R₁)-, -N(R₁)CON(R₁)- and -N(R₁)CO₂-, and containing 1-12 carbon atoms in which R₁ has the same meaning as defined above; and

R₂ is -CH=CH₂ or -CH₂-CH₂X₁ wherein X₁ is a substituent replaceable by a nucleophilic group or releasable in the form of HX₁ by a base.

62. The composition of Claim 61 wherein X₁ represents -S₂O₃⁻, -SO₄⁻, -Cl, -Br, -I, quaternary ammonium, pyridinium, and -CN, and sulfonate esters.

63. The composition of claim 44 wherein further comprising a bioaffinity tag bound to the surface of said bead.

64. The composition of claim 63 wherein said bioaffinity tag comprises at least one member selected from the group consisting of nucleic acids, antibodies, proteins, polysaccharides, oligonucleotides, peptide nucleic acid (PNA), peptides, antibodies, antigens, enzymes, proteins, and synthetic molecules having biological activities